Morphing Control Surface for Improved Efficiency and Maneuverability, Phase I

Completed Technology Project (2009 - 2009)

Project Introduction

The current technology push in advanced aerospace flight systems is to replicate certain features seen in nature. Morphing aircraft, particularly unmanned air vehicles (UAVs), have thus received considerable attention in this respect. Aside from safety and aerodynamic efficiency, a single morphing UAV platform could possess the ability to carry out multiple mission objectives. Nearly all forms of conformal morphing vehicles have since been investigated, including twist, camber, span, and sweep, where simulation results showed the potential performance benefits that could be achieved. It was not until recently that material and actuator technology had reached a point of development that allowed viable prototypes to be fabricated and tested, however. Having successfully researched, designed, and evaluated supporting technologies, Techno-Sciences, Inc. proposes to develop an innovative morphing control surface system that is capable of in-plane (span extension) reconfiguration, sized and scaled for a candidate subsonic fixed-wing UAV platform. This morphing system will make use of high performance, light weight actuators to articulate the shape change, a morphing core to provide structural support, and a flexible skin as a viable aerodynamic surface layer. All components are custom-made in-house from COTS elements and have patents pending. The proposed research plan will work to design the morphing system to fit inside the volumetric constraints of the host vehicle with the goal of increasing efficiency and maneuverability. The Phase I program will end with prototype evaluations of a morphing wing section under representative loading. Successful demonstration here will lead to integration with the UAV and a flight test in Phase II.

Anticipated Benefits

Potential NASA Commercial Applications: The morphing control surface system for improved flight performance characteristics will be applicable to a wide range of end-users in the defense, commercial, and industry sectors. Its broad applicability is enabled by the custom-fabricated components. More efficient control surfaces featuring chord/span extension and contraction and camber change are particularly attractive to the military. Increased efficiency allows for longer missions to take place, whether they be mapping of unexploded ordnance, monitoring of assets, or other ISR-related tasks. Other applications include supporting mine detection, biochemical weapons cleanup, and operations in other hazardous environments or rough terrain. Additionally, research in biomimetics and reconfigurable dwellings are other opportunities for application. It should be emphasized that while the proposed development focuses on a small UAV, the enabling technologies are scalable to larger craft using established design laws and material selection criteria. Overall, the proposed technology will be an integrated hardware/software product that can be licensed for manufacture. Techno-Sciences, Inc. already enjoys market share of related technologies through our existing customers, and we plan to leverage these marketing outlets and offer custom-design morphing control

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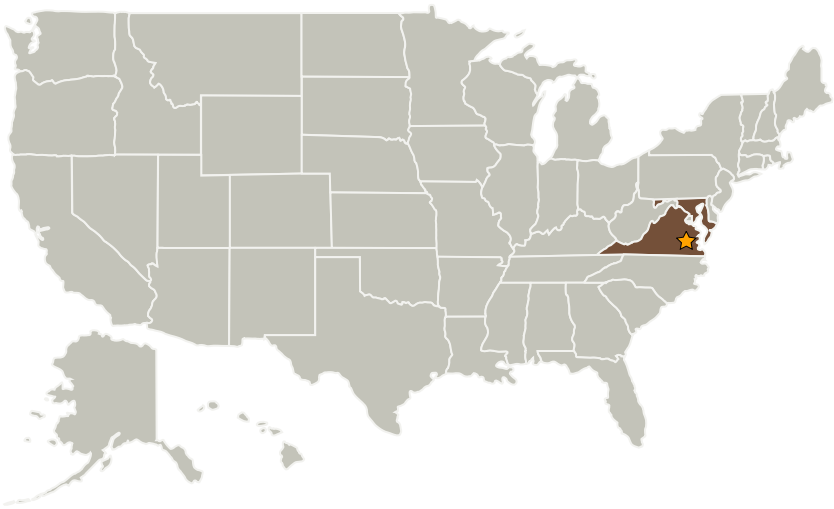
surface systems.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
Techno-Sciences, Inc.	Supporting Organization	Industry	Beltsville, Maryland

Primary U.S. Work Locations	
Maryland	Virginia

Project Transitions

January 2009: Project Start

July 2009: Closed out

Closeout Summary: Morphing Control Surface for Improved Efficiency and Man euverability, Phase I Project Image

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

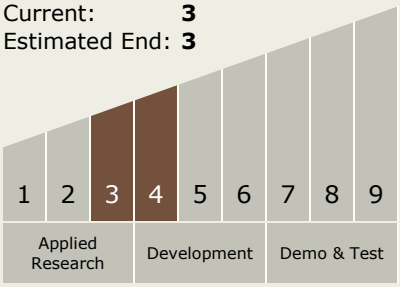
Carlos Torrez

Principal Investigator:

Kothera Curt

Technology Maturity (TRL)

Start: **4**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.3 Aeroelasticity